THE RELATION OF DISEASE OF THE GALL-BLADDER AND BILIARY DUCTS TO THE GASTRIC FUNCTIONS.

By John A. Lichty, M.D.,
ASSOCIATE PROFESSOR OF MEDICINE IN THE UNIVERSITY OF PITTSBURG.

The effect of certain pathological conditions of the stomach upon the physiological functions of the stomach has engaged the attention of physicians for a number of years. Gastric ulcer, with the associated hyperchlorhydria, is well known. It is only within the past half-decade, or more, that we have begun to realize that a lesion anywhere in the gastro-intestinal tract, or its associated organs, may disturb the gastric functions. We now hear of "acid appendix dyspepsia," of "flatulent gallstone dyspepsia," etc. This has, no doubt, resulted from the very active surgical interference in diseases of the organs of the abdomen, especially of the upper abdomen. The surgeons, among whom are principally Moynihan, Mayo Robson, Paterson, the Mayos, Maurice Richardson, and Deaver, were the first to write of these dyspepsias. My attention was called to this relation some years ago, but more definitely since the meeting of the American Gastro-enterological Association in Boston, where our present presiding officer read a very suggestive paper upon the association of cholelithiasis and hyperchlorhydria.

In looking through the histories of my own cases which bear upon this subject, I have found 249 patients in whom the diagnosis of some disease of the gall-bladder and ducts had been made; and in 258 patients in whom the diagnosis of appendicitis had been made a large percentage had a positive disturbance of the secretory as well as of the motor function of the stomach. In this paper I wish to refer more particularly to the relation between gall-bladder and duct disease to disturbance of the gastric functions, and I shall, therefore, analyze rather closely the 249 cases of gall-bladder and duct affections. In 156 of these cases gastric analyses were made with the usual methods employed clinically to determine the secretory and motor condition of the stomach; 84 (54 per cent.), had a hyperacidity, 31 (20 per cent.) had a subacidity, and 41 (26 per cent.), had a normal secretion. The motor function, so far as could be determined, was normal in about the same per-cent. of cases. Of the 249 cases upon which these observations were made, 51 cases came to operation; 30 of these had gastric analyses made; 16 (about 53 per cent.) had a hyperacidity, 8 (about 26 per cent.) had a subacidity, and 6 (about 20 per cent.) had a normal acidity. In a number of the 249 cases the gastric analyses were made because there were definite symptoms of gastric disturbance associated with the gall-bladder symptoms, but in some it was made because the gastric symptoms were the only ones present, and later, when treatment did not produce the desired results, the abdomen was opened and either gallstones were found, or adhesions from a local peritonitis, due to gall-bladder infection, had occurred between the gall-bladder and duodenum, between the gall-bladder and stomach, or both. In several cases both gallstones and gastric ulcer were found.

	No.	Hyperacid.	Normal.	Hypoacid.
Total gall-bladder cases . . .	249			
Cases with gastric analyses . .	156	84 (54%)	41 (26%)	31 (20%)
Total cases operated on . . .	51			
Cases with gastric analyses . .	30	16 (53%)	6 (20%)	8 (26%)

The number of cases upon which these figures are based is, of course, not large, but I have had access to the statistics of other men, and my experience does not seem unusual. My brother, Dr. M. J. Lichty, of Cleveland, gives the following figures. Of 36 gall-bladder and duct cases, 28 had gastric analyses; 19 had a hyperacidity, 5 had a subacidity, and in 4 the secretion was normal.

From these figures it would seem that about 75 per cent. of all gall-bladder cases may be associated with a disturbance of gastric secretion, and of this 75 per cent., two-thirds have hyperchlorhydria. Gastric motility, as well as gastric secretion, was disturbed in about the same proportion of cases. In these days much is said about disturbance of gastric motility and of its relative value clinically compared with gastric secretory disturbances. It is scarcely necessary to draw such distinctions, because the two may frequently be associated in some cases, and, in others one may predominate, while in still others the other predominates. When the statement is made that gastric analyses are misleading, that the motility of the stomach is more important than is the secretory function, it gives evidence that the observer has not made many complete gastric analyses, or that he has misinterpreted his findings.

In presenting these cases, I must necessarily omit a narration of the details of dyspeptic symptoms which pointed to gastric secretory and motor disturbances, but which are not usually mentioned in text-book descriptions of gall-bladder and duct affections. My main object is to show that certain gastric disturbances are rather constant in these cases, and, if persistent, they may lead one to a diagnosis of the real condition, independently of such pronounced symptoms as jaundice and biliary colic.

Rolleston[1] says: "Indigestion is a frequent result of gallstones;

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[1] Disease of the Liver, Gall-bladder, and Bile Ducts.

so-called irregular biliary colic not infrequently manifests itself as dyspepsia, and may be due to adhesions between the gall-bladder and stomach" (or duodenum). But later he says that during the attacks of biliary colic the amount of HCl is either normal or diminished. I think myself, in the height of the attack of biliary colic the secretions may be subnormal, but between the attacks they are more often increased. In some of my cases, repeated examination of the vomitus, during an attack of biliary colic, showed an absence of free HCl and a low total acidity, but the gastric analysis during the interval always showed a hyperchlorhydria. The following case illustrates this well:

Mrs. S., aged twenty-nine years, has had nausea and vomiting for the past five months, but no pain. Four months ago she had a similar attack. A year ago, with such an attack, she had fever, which lasted two weeks and was thought to be typhoid. In the interval the patient had burning and gnawing in the stomach two hours after meals, which was relieved by taking food. Eight years ago the patient had jaundice. At the age of nine years she had a severe attack of typhoid fever. The analysis of the vomitus during the attack for which she consulted me showed no free HCl and a total acidity of only 12. After the attack had subsided, and when she was on her usual diet, an Ewald test breakfast was given and the free HCl was 24, combined 40, and total acid 68. At the operation the gall-bladder was found thick, white, and large, with a stone in the cystic duct. There were no adhesions. The appendix, which was thick, large, and bound down with adhesions, was removed.

It is a matter of observation by many that a patient who has gallstones may give a history of being disturbed in his sleep about 3 A.M., with discomfort or pain in the epigastrium, similar to the discomfort which a patient having a hyperchlorhydria or a so-called nervous dyspepsia experiences.

Moynihan[2] in an article upon appendix dyspepsia, refers to the occurrence of hyperchlorhydria, or acid dyspepsia, in association with many cases of chronic appendicitis. My experience in over 258 cases of appendicitis, of which, 127 were operated upon and 111 had gastric analyses made, confirms Mr. Moynihan's experience. In the last few years I have called the attention of some of my medical and surgical colleagues to these facts, and all seemed to be of the opinion that there are nearly always rather definite symptoms of gastric disturbances associated with disease of the gall-bladder and ducts, and also with disease of the appendix.

There seems, therefore, a rather uniform opinion that gall-bladder and duct disturbance is associated with symptoms of dyspepsia, such as are usually referred to some disorder of gastric function. The question now arises, Is there usually a certain demonstrable alteration of gastric function, that is, of secretion and motility, in these cases, and if there is, is it secondary to pathological lesions elsewhere in the gastro-intestinal tract, or is it merely a coincidence?

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[2] Brit. Med. Jour., January 29, 1910.

From the experiments of Pawlow, Starling, Cannon, and Murphy, we can very readily see how a lesion in the gall-bladder and ducts, especially when it has caused local peritoneal adhesions, might produce a pylorospasm and thus disturb both the secretory and motor function of the stomach. It is now generally accepted, especially since Cannon's experiments, that the dominant control of the pylorus lies on the duodenal side of the pylorus, and any disturbance there, such as of the biliary, pancreatic, or duodenal function, may disturb the normally well-balanced mechanism of the pylorus. Cannon and Murphy[3] have shown in cats, by an end-to-end anatomosis high in the intestines, that food will leave the stomach only after five or six hours, whereas normally it leaves within ten minutes. Moynihan, in the article on appendix dyspepsia already referred to, suggests that the action of the pylorus as shown by these experiments seems to be protective, and in this way explains the effect of a lesion of the appendix upon gastric function.

I have attempted in the last year or more to determine whether any change in gastric function would occur in dogs in which an artificial lesion of the gall-bladder, corresponding to cholelithiasis in the human subject, had been produced. The primary object of these experiments was not so much to determine specifically the relation of gall-bladder disease to gastric function as to attempt to find a pathological basis, or explanation, for some of the great number of cases of so-called hyperchlorhydria which are now being recognized by both the internist and the surgeon. It seems to have been the tendency, until recently, to look upon patients who have a gastric hypersecretion, but no definite symptoms of gastric or duodenal ulcer, as being simply neurotic and worthy of only scant consideration. I find myself guilty of this error as I review the histories of some cases which had a gastric hypersecretion, for not infrequently have I found these patients (who gave definite symptoms of gastric hypersecretion, and in whom the condition was verified by gastric analyses) suddenly develop definite gallstone or appendix symptoms, and at the operation reveal pathological conditions which must have been the foundation for the whole train of gastric symptoms.

The experiments upon dogs referred to were conducted in the laboratories of the Columbia Hospital with the assistance of Dr. John W. Dixon, assistant surgeon to the hospital, and Dr. Florence Kline, in charge of my private laboratory, to both of whom I wish to acknowledge my indebtedness for surgical and laboratory technique which I had neither the ability nor time to perform myself. We took six healthy dogs of average size and determined as nearly as possible their normal gastric function after a test meal similar to the Ewald test breakfast usually employed clinically. Gastric secretion, as well as motility, was observed as nearly as possible as it is in man. The technique was as follows: Two ounces of bread was thoroughly dried and broken into small pieces and soaked in eight ounces of water, so as to make an emulsion which could be easily injected through a stomach tube. A dog, after having fasted for ten or twelve hours, was given this portion through a stomach tube which had been passed into the stomach. At the end of thirty or forty minutes the stomach was aspirated by inserting the stomach tube with a politzer bag attached. The contents thus recovered was filtered and the acidity estimated by titrating with a decinormal sodium hydroxide solution.

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[3] Annals of Surgery, 1906, p. 512.

A number of tests were made in this way until the results became rather constant, or until a fairly definite average was obtained. At a sufficient time after the dog became accustomed to his new surroundings, and also to the passing of the tube to determine his individual acidity and motility, the abdomen was opened under anesthesia and a foreign body, usually a hard cinder from the furnace room, which had previously been dipped into a culture containing streptococci, or mixed microörganisms, was inserted into the gall-bladder, which was opened and again carefully closed and returned into the abdominal cavity. After the dog had recovered from the immediate effects of the operation and was again upon a general diet, the analyses of the stomach contents were resumed, and, after a certain time, a comparison made between the gastric analyses before and after the operation. Five dogs were operated upon and foreign bodies inserted into the gall-bladder, the sixth being kept as a control.

Dog No. 2, after having twenty-three test breakfasts given in the course of thirty-one days, showed an average acidity represented by 23.7, and was operated upon, under ether anesthesia, January 19, 1910. The gall-bladder was delivered through a Kocher's incision, opened, and a rough cinder the size of a pecan was inserted. The gall-bladder was closed and returned to the abdominal cavity. Recovery was satisfactory. On January 25, when the dog was taking his usual diet, the test breakfasts were resumed. It was very soon found that the stomach did not empty as promptly as before the operation. In sixty-five days twenty-seven test breakfasts were given, showing an average total acidity of 28, or a gain of 4.6 points. On March 25, 1910, the abdominal cavity was again opened for the purpose of producing a lesion at the cecal pouch (appendix). The gall-bladder was found very much shrunken and tucked up as far beneath the liver as possible.

Dog No. 4 had thirty-two test meals in forty-three days, with an average acidity of 21. Was operated upon, February 9, 1910. A cinder, which had previously been dipped into a culture of streptococci, was inserted into the gall-bladder with the usual technique. In the course of sixty days twenty test breakfasts were given, with an average acidity of 19. On April 1, 1910, the abdomen was opened, and a few firm adhesions were found binding the omentum to the gall-bladder.

Dog No. 5, after twenty test meals in twenty-eight days, showed an average acidity of 22.8. Was operated upon, February 10, 1910. A cinder infected from a mixed culture was inserted into the gall-bladder. Following the operation the wound in the abdominal wall was opened and there was a marked local infection, which, however, finally granulated over nicely. After the dog had entirely recovered from the operation, twenty-four test meals were given in sixty-three days, with an average acidity of 33.3. On April 15, 1910, an exploratory abdominal operation was done, and extensive adhesions were found between the gall-bladder, omentum, and abdominal wall.

Dog No. 6 had thirty-one test meals in forty-one days, with an average total acidity of 21.8. Was operated upon, March 18, 1910, and a cinder infected with pus from a patient having puerperal septicemia was inserted into the gall-bladder. The incision healed without any infection. After recovery from the operation twenty-five test meals were given in sixty-eight days, with an average total acidity of 24.5.

Dog No. 7 had fourteen test meals in fifteen days, with an average total acidity of 24.6. Operated on February 25, 1910, and a cinder infected from a streptococcus culture was inserted into the gall-bladder; the wound closed without any infection. After the operation twenty-one test meals were given in fifty-nine days, with an average total acidity of 37.5, or an increase of 13 points. On April 22 the abdomen was again opened for the purpose of examining the gall-bladder and producing a lesion in the appendiceal pouch. The gall-bladder was very small and high under the liver. It was bound down by a great many tense bands of adhesions.

The average results of the analyses of the gastric secretion are as follows:

	Before operation.			After gall-bladder operation.		
	Test meals.	Days.	Average acidity.	Test meals.	Days.	Average acidity.
Dog No. 2	23	31	23.7	27	65	28.0
Dog No. 4	32	43	21.0	20	60	19.0
Dog No. 5	20	28	22.8	24	63	33.3
Dog No. 6	31	41	21.8	25	68	24.5
Dog No. 7	14	15	24.6	21	59	37.6
Dog No. 8	24	58	16.7			

It will be seen that in Dogs Nos. 2, 5, and 7 considerable change in the gastric secretion took place. The motility also was disturbed. When these experiments were begun, it was intended to aspirate the stomach an hour after the test meals had been given, as is done clinically, but we soon learned that the gastric motility in the dog was more rapid than in man; we, therefore, withdrew the contents in thirty minutes, and even then sometimes did not obtain a satisfactory amount. After the gall-bladder operations this was suddenly changed, and at the end of thirty and even forty and fifty minutes abundant amounts could be aspirated. This change was so evident and constant that we concluded the motility of the dog's stomach was decidedly disturbed as the result of the pathological conditions which the foreign body in the gall-bladder had produced. The change, or delay, in motility seemed to be in direct proportion to the extent of the lesions produced.

It seemed to us with this technique we were able to produce conditions and determine results in the dog very nearly as they are found clinically, and that we had, as nearly as possible, met the necessary requirements for conducting an experiment. We, of course, appreciate that the Ewald test breakfast does not give us scientifically correct information of gastric function, and yet it is the method generally employed clinically. The Pawlow artificial second stomach pouch, or cul-de-sac, was not employed in these experiments, because we were of the opinion that a disturbance of the normal gastric secretion and motility would be caused by the operation itself and the consequent adhesions. We hope to confirm this opinion by experiments which are now being conducted in our laboratory.

Our technique might be objected to on the ground that a meal forcibly injected into a dog's stomach would not excite the amount of secretion or degree of motility occurring after a meal which the dog had taken with his proverbial relish and greed. But the object of the experiment was not so much to determine the normal gastric secretion in dogs as to determine whether the constant secretion and motility found by a certain technique would be disturbed by producing a lesion in the gall-bladder and ducts.

We attempted to check up our experiments by having a sixth dog as control in the same kennel with the dogs which had been operated upon, whose stomach contents were examined every few days, but who was not subjected to operation. We very soon learned that a number of factors, such as irregularity of feeding, disturbance of health and comfort, segregation of the dogs, and the introduction of a keeper who was not agreeable to them, influenced gastric secretion quite decidedly, but we attempted in every way possible to obviate these factors, and we feel that our results are as reliable, if not more so, than those obtained clinically.

I feel, therefore, inasmuch as my own clinical experience, together with that of the large experience of other clinicians, seems to be confirmed by the experimental evidence which I have attempted to present, that I might safely draw the following conclusions:

1. A lesion of the gall-bladder and ducts may disturb the gastric functions.

2. This disturbance most frequently consists of a hypersecretion of gastric juice and a diminution of gastric motility, and may be in direct proportion to the lesions present.

3. So-called hyperchlorhydria, with its accompanying symptoms, should be looked upon as an evidence of some definite pathological lesion somewhere in the gastro-intestinal tract or its appendages, and should be treated symptomatically only when organic disease can be excluded with a satisfactory degree of certainty.

THE DYSPEPSIA OF OLD AGE.

By Geo. M. Niles, M.D.,

PROFESSOR OF PHYSIOLOGY IN THE SOUTHERN COLLEGE OF PHARMACY; ASSOCIATE PROFESSOR OF PHYSIOLOGY IN THE ATLANTA SCHOOL OF MEDICINE; AND GASTRO-ENTEROLOGIST TO THE TABERNACLE INFIRMARY, ATLANTA, GEORGIA.

For a number of years certain digestive disorders in old people have come under my observation, and in these the cause seemed purely dependent on the changes incident to advanced years. The manifestations of senility shown by atheromas, degenerations, ossifications, calcifications, etc., have been discussed at length by contemporary medical writers, but some of the strictly gastro-intestinal distubrances have received scant notice, being regarded more as pathological features of maturity than normal accompaniments of old age. Gereology we find laid down already, and Dr. Nascher, of New York, recently suggested the term geriatrics to cover the same field in old age that pediatrics covers in childhood.

It may be of interest, therefore, to consider some of the dyspepsias of this advanced period of life as radically different from those occurring during the height of adult vigor, while normal metabolism should be waging an equal warfare between the constructive and destructive forces. According to Fenwick's investigations, out of every 100 cases of chronic dyspepsia in persons over sixty-five years of age, 66 are secondary to organic diseases of some important organs of the body, while 34 owe their symptoms to a progressive degeneration of the secretory structures of the stomach and intestines.

The stress of over sixty-five years of bodily activity will, in a majority of cases (at least two-thirds), result in disease of either the kidneys, prostate, heart, lungs, liver, pancreas, or a chronic gouty condition, which will set up a chronic asthenic gastritis; while in a